130I-1

BILL OF MATERIALS

AG 130-I

UNIT OBJECTIVE

After completion of this unit, students will be able to identify the standard measurements of lumber, steel and pipe, complete cost calculations, and know how to use of a bill of materials. This knowledge will be demonstrated by completion of assignment sheets and a unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Understand basic terms associated with a bill of materials.
2. Identify the components of a bill of materials.
3. Select from a list of standard measurements in width and length by which most lumber and steel products are sold.
4. Calculate board feet.
5. Calculate cost of materials.
6. Complete a bill of materials.
7. Determine cost of a project.
8. Estimate building materials.

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COMPONENTS OF A BILL OF MATERIALS

A. Terms and Definitions

1. Bill of Materials – Itemized list of the number of pieces needed and the dimensions of each for the construction or repair of a project.
2. Board Foot – Piece of lumber 1 inch thick, 12 inches long, and 12 inches wide.
3. Running Foot – Foot length of a material regardless of thickness and width.
4. Square Foot – Equal to a 12-inch by 12-inch surface regardless of thickness
5. Cubic Foot – Measurement 12 inches long by 12 inches wide by 12 inches thick.
6. Surfaced Lumber – Lumber that has been surfaced by running through a planer.
7. Rough Stock – Lumber that has been sawed to dimension but not planed; usually thicker and wider than surfaced lumber.
8. Planer – Machine that smoothes the surface of rough lumber.
9. Gauge – Unit of measurement for thickness of metal. Sheet metal is sold by gauge thickness up to 10 gauge, then metal becomes plate.

B. Bill of Materials

1. Date
2. Name and address of seller and purchaser
3. Project or job
4. Number of pieces
5. Description
6. Dimensions of material
7. Unit cost per kind of material
8. Total cost
9. Name of person who received the materials

C. Standard Measurements

1. Lumber (Standard Length; 6', 8', 10', 12', 14', and 16')

a. 1" X 4"	e. 1" X 12"	i. 2" X 10"
b. 1" X 6"	f. 2" X 4"	j. 2" X 12"
c. 1" X 8"	g. 2" X 6"	k. 4" X 4"
d. 1" X 10"	h. 2" X 8"	l. 4" X 6"

2. Plywood (Standard Size = 4' X 8')

a. Thickness:

1) 1/4"
2) 3/8"
3) 1/2"
4) 5/8"
5) 3/4"
6) 1"

3. Steel (Standard Length = 20 Feet)

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a. Flat Iron

1) Thickness

a) 1/8"
b) 3/16"
c) 1/4"
d) 5/16"
e) 3/8"
f) 1/2"

2) Width

a) 1/2"
b) 3/4"
c) 1"
d) 1 ½
e) 2"
f) 3"
g) 4"

b. Angle Iron

1) Thickness

a) 1/8"
b) 3/16"
c) 1/4"
d) 5/16"
e) 3/8"
f) 1/2"

2) Width (width of legs)

a) 1/2" X 1/2"
b) 3/4" X 3/4"
c) 1" X 1"
d) 1 ½ X 1 ½
e) 2" X 2"
f) 3" X 3"

c. Round Stock: Hot and Cold Rolled

1) Thickness

a) 1/4"
b) 5/16"
c) 3/8"
d) 1/4"
e) 5/8"
f) 3/4"
g) 1"
h) 1 ½"
i) 2"

d. Pipe, Black or Galvanized (Standard Length = 21 Feet)

1) Schedule relate to wall thickness
2) Size based on approximation of inside diameter

a) 1/4"
b) 3/8"
c) 1/2"
d) 3/4"
e) 1"
f) 1 ¼"
g) 1 ½"
h) 2"
i) 2 ½"
j) 3"

D. Symbols used on the Bill of Materials

1. ea = each
2. @ = at
3. " or in = inch
4. ' or ft = foot
5. yd = yard
6. mi = mile
7. N/A = not applicable
8. pt = pint
9. qt = quart
10. gal = gallon
11. LF = linear foot
12. BF = board foot
13. S1S = surface 1 side
14. S2S = surface 2 sides
15. S3S = surface 3 sides
16. S4S = surface 4 sides
17. No. or # = number
18. in^2 or sq in = square inch
19. ft^2 or sq ft = square foot
20. yd^2 or sq yd = square yard
21. NC = national coarse threads
22. NF = national fine threads
23. NPT = national pipe threads
24. d = penny
25. lb = pound
26. oz = ounce
27. Cwt = hundredweight (100 pounds)

E. Types of Bill of Materials

1. Lumber and Hardware (Page 130I-7)

a. Item
b. No. of Pieces
c. Size
d. Length
e. Description
f. Unit Price (per lb, gallon, etc.)
g. Total Price

2. Steel (Page 130I-9)

a. No of Pieces
b. Description
c. Size
d. Quantity (lbs)
e. Price per Pound
f. Total Price

3. Engine Parts (Page 130I-11)

a. Parts Needed (Quantity and Description)
b. Picture Number
c. Parts No.
d. Price

F Cost Calculation on Different Types of Bill of Materials

1. Lumber, is sold by the individual board, sheet or by the board foot.

a. No. of pieces (or BF) X Unit Price = Total Price
b. Total Price + Cost from other sheet (if needed) + Shop Fee = Sub Total
c. Sub Total + Taxes + Total Cost

2. Calculating Board Feet and Cost

a. $\frac{\text{No. of pieces X thickness in inches X width X length in FEET}}{12}$

b. $\frac{\text{No. of pieces X thickness in inches X width X length in INCHES}}{144}$

Example: 1) One board 2" thick X 4" wide X 12' long
2) One board 2" thick X 4" wide X 144" long

1) $\frac{1 \text{ X } 2\text{" X } 4\text{" X } 12'}{12} = 8$ board feet

2) $\frac{1 \text{ X } 2\text{" X } 4\text{" X } 144\text{"}}{144} = 8$ board feet

@ 30 cents a board foot
8 board feet X $0.30 = $2.40

Item	No. pieces	Size	Length	Description	Unit price	Total price
board	2	2" X 4"	12'	S2S	$2.40	4.80

3. Steel, is sold by the pound.

a. No. of Pieces X Quantity (lbs) X Price per Pound = Total Price

Example: 1) 2 X 20' X 3.273 X $0.30 = $39.28
2) 3 X 20' X 2.340 X $0.30 = $42.12

No Pieces	Size & Description	Length	Quantity (lbs per foot)	Price per Pound	Total price
2	2" X 2" X 1/4" angle iron	20'	3.273	$0.30	39.28
3	1 ½ X 1 ½ X 1/4" angle iron	20'	2.340	$0.30	42.12

b. Total Price + Cost from other sheet (if needed) + Shop Fee = Sub Total
c. Sub Total + Taxes = Total Cost

4. Engine Parts

a. Parts Needed X Price = Price
b. Price + Cost from other sheet (if needed) + Shop Fee = Sub Total
c. Sub Total + Taxes = Total Cost

PARTS NEEDED	PICTURE NO.	PARTS NO.	PRICE
(1) exhaust valve	33	211 119	9.90

Reference:

Cooper, Elmer L. (1997). AGRICULTURAL MECHANICS: FUNDAMENTALS AND APPLICATIONS, 3ed EDITION. Albany, NY: Delmar Publihsers.

Joseph T. Ryerson & Son, Inc. (1995). RYERSON STOCK LIST. Chicago, IL 312/762-2121

Special Materials:

Price lists from the local lumber and steel supplier.
Price list from Briggs & Stratton, (414) 259-5333 or www.briggsandstratton.com

Activity
1. Use a student's project and make out a bill of materials for that project.
2. Have the students make out a bill of materials every time they make a project.

BILL OF MATERIALS
HARDWARE & LUMBER

Sold To____ Date_____________________

Project or Job____

HARDWARE/LUMBER COMPANY
1111 West First Street, Anytown 555-1212

TERMS: CASH CHARGE ACCT.

Item	No. pieces	Size	Length	Description	Unit price	Total price

Cost from other sheet (if needed)	
Shop Fee	
Sub total	
Taxes	
Total Cost	
Received by____	

Item	No. pieces	Size	Length	Description	Unit price	Total price
Total cost						

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BILL OF MATERIALS
STEEL

Sold To_____ Date_____

Project or Job_____

STEEL COMPANY
1111 West First Street, Anytown 555-1212

TERMS: CASH CHARGE ACCT.

No Pieces	Size & Description	Length	Quantity (lbs)	Price per Pound	Total price
Cost from other sheet (if needed)					
Welding Fee					
Sub total					
Taxes					
Total Cost					
Received by_____					

No Pieces	Size & Description	Length	Quantity (lbs)	Price per Pound	Total price
Total cost					

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BILL OF MATERIALS
ENGINE PARTS

Owner's Name_____ Date_____

Student's Name_____ TERMS:

Engine Model No._____ CASH
Type No. _____
Serial No. _____ CHARGE ACCT.

PARTS NEEDED	PICTURE NO.	PARTS NO.	PRICE

Cost from other sheet (if needed)	
Shop Fee	
Sub total	
Taxes	
Total Cost	
Received by_____	

PARTS NEEDED	PICTURE NO.	PARTS NO.	PRICE
Total cost			

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Name_____
Date_____

BILL OF MATERIALS, QUIZ

Answer the following questions with a short answer

1. What is a Bill of Materials?

2. What is the standard length for steel?

3. List three different thicknesses for plywood.

4. What does the symbol S2S mean?

5. What is the standard length for pipe?

Fill in the Bill of materials with the information below.
You are working on a project that requires eight 2"X4"s ten feet long ($4.00 ea), five 1"X4"s fourteen feet long ($3.30 ea), eight 2"X4" joist hangers ($0.30 ea), quarter of a pound of sheet metal roofing screws ($14.00 per lb), one pound of 2" wood screws ($2.30 per lb), seven sheets of 26"X10' ribbed roofing sheet metal($11.00 ea), and one gallon of red exterior paint ($18.50 per gal).

Item	No. pieces	Size	Length	Description	Unit price	Total price
Sub total						
Taxes (Sales tax in Idaho is 5%)						
Total Cost						
Received by_____						

Bonus Question; What kind of project is this material going to be used for?

Answer Sheet

1. A Bill of materials is an itemized list of the number of pieces needed and the dimensions of each for the construction or repair of a project.
2. Steel comes in a standard length of 20'.
3. 1/4", 3/8", 1/2", 5/8", 3/4", and 1" (any three)
4. S2S means, Smooth surface on two sides.
5. The standard length of pipe is 21'.

Item	No. pieces	Size	Length	Description	Unit price	Total price
lumber	8	2"X4"	10'	2"X4", 10', lumber	$4.00	$32.00
lumber	5	1"X4"	14'	1"X4",14', lumber	$3.30	$16.50
J/H	8	2"X4"	N/A	Joist Hangers	$0.30	$2.40
screws	1/2lb	2"	N/A	Wood Screws	$2.40	$1.70
screws	1/4lb	2"	N/A	Roofing Screws, Sheet Metal	$14.00	$3.50
metal	7	26"	10'	Ribbed Sheet Metal, Roofing	$11.00	$77.00
paint	1	1gal	N/A	Gallon of Paint, Red, Exterior	$18.50	$18.50
Sub total						$151.60
Taxes (Sales tax in Idaho is 5%) 0.05 X Sub total =						$7.58
Total Cost						$159.18
Received by_____						

Bonus Question; Roofing project for a car port, patio, storage ,etc.